STATINTL

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STRUCTURAL DESIGN CRITERIA

LIVE LOADS

Roof	20 PSF
Floor	150 PSF

SEISMIC LOADS

For structure as a whole	F = 0.067 W
Parapet Walls	F = 1.00 W
Other walls, normal to surface	F = 0.20 W

WIND LOAD

Based on 100 MPH — q = 26 PSF

ALLOWABLE STRESSES

Concrete

Footing, slab on grade -	fc' = 2500 PSI,	fc =	**1125**	n =	10
All others,	fc' = 3000 PSI,	fc =	1350,	n =	9

Reinforcing steel, intermediate grade, deformed,

	fy = 40,000 PSI		fs = 20,000 PSI	
Masonry Units,	fm' = 800 PSI		fm = 267 PSI	

Increase in allowable stresses for combined loading

DL + LL + SEIS	33%
DL + LL + WIND	33%

ALLOWABLE SOIL PRESSURE

1200 PSF

DESIGN REFERENCES:

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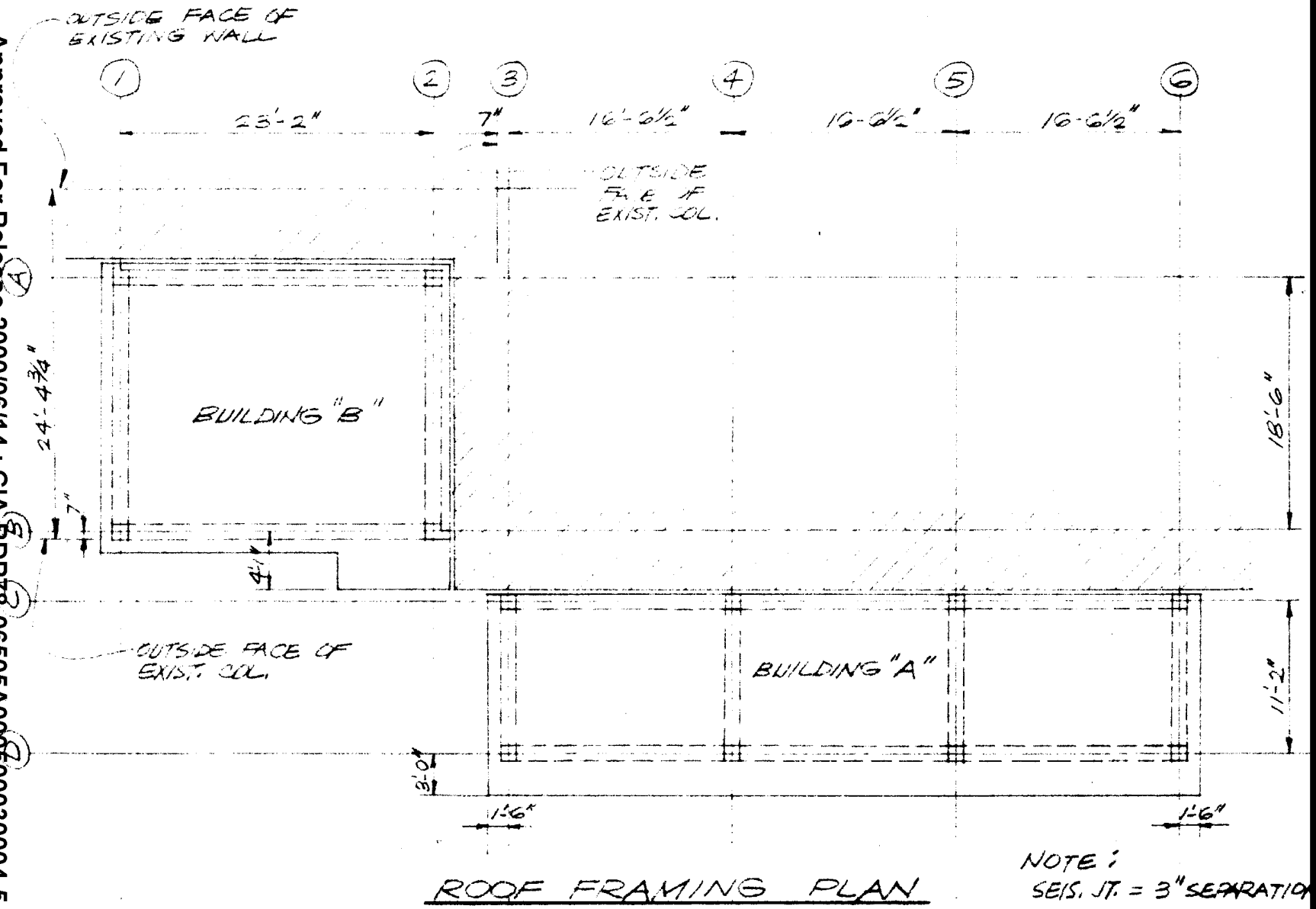

ROOF FRAMING PLAN

NOTE:
SEIS. JT. = 3" SEPARATION

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ROOF SLAB (TWO-WAY, THREE EDGES DISCONT., 16.54' × 11.17')

LOAD:

4" SLAB	— .050	KSF
ROOFING	— .006	
A/C DUCTS, ETC.	— .004	
DL =	.060	KSF
LL =	.020	
W = DL + LL =	.080	KSF

$MIN.\ t = \frac{24}{180}(16.54 + 11.17) = \frac{4 \times 27.71}{30}$

$= 3.70"$

USE $t = 4"$ $d_1 = 3.0"$ $d_2 = 2.5"$

$m = \frac{11.17}{16.54} = 0.675$

$wS^2 = .080 \times 11.17^2 = 10.0\ ^{KF}/_{LF}$

$M_{SD} = 10.0 \times .042 = 0.42\ ^{KF}/_{LF}$ — $A_s = \frac{0.42}{1.44 \times 3.0} = .097\ ^{IN^2}/_{LF}$ — #3@12"

$M_{SP} = 10.0 \times .064 = 0.64$ — $A_s = \frac{0.64}{1.44 \times 3.0} = .148\ ^{IN^2}/_{LF}$ — #3@9"

$M_{LC} = 10.0 \times .058 = 0.58$ — $A_s = \frac{0.58}{1.44 \times 2.5} = .161\ ^{IN^2}/_{LF}$ — #3@8"

$M_{LP} = 10.0 \times .044 = 0.44$ — $A_s = \frac{0.44}{1.44 \times 2.5} = .122\ ^{IN^2}/_{LF}$ — #3@10"

$V = .080 \times 11.17 \times 1/2 = 0.447\ ^{K}/_{LF}$ — $\Sigma o/D = \frac{447}{186 \times 7/8 \times 2.5} = 1.10\ ^{IN}/_{LF}$ — @12"

ROOF SLAB (TWO-WAY, TWO EDGES DISCONT., 16.54' × 11.17')

$W = .080$ KSF $\quad m = .675 \quad t = 4"$

$wS^2 = 10.0\ ^{KF}/_{LF} \quad d_1 = 3.0" \quad d_2 = 2.5"$

$M_{SD} = 10.0 \times .037 = 0.37\ ^{KF}/_{LF}$ — $A_s = \frac{0.37}{1.44 \times 3.0} = .086\ ^{IN^2}/_{LF}$ — #3@12"

$M_{SP} = 10.0 \times .055 = 0.55$ — $A_s = \frac{0.55}{1.44 \times 3.0} = .127$ — #3@10"

$M_{LC} = 10.0 \times .049 = 0.49$ — $A_s = \frac{0.49}{1.44 \times 2.5} = .136$ — #3@9"

$M_{LP} = 10.0 \times .037 = 0.37$ — $A_s = \frac{0.37}{1.44 \times 2.5} = .103$ — #3@12"

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ROOF SLAB OVERHANG (L' = 3.00')

LOAD:

8" SLAB — 0.100 KSF

ROOFING — .006

DL = 0.106 KSF

LL = 0.020

W = 0.126 KSF

THICKNESS OF SLAB AT SUPPORT = 6"

d = 5"

$V = 0.126 \times 3.00 = 0.378$ KLF — $\frac{E_o}{D} = \frac{378}{186 \times 7/8 \times 5} = .465$ "/F — @12"

$M = 0.378 \times \frac{3.00}{2} = .567$ K'/LF — $A_s = \frac{.567}{1.44 \times 5} = .079$ □"/F — #3@12"

TEMP. $A_s = .002 \times 12 \times 7 = .168$ □"/F — #3@8"

BEAM ALONG LINE (4) OR (5)

GRAVITY LOAD:

SLAB + LL — $.080 \times 11.17 \times \frac{2}{3} = 0.60$ KLF

BEAM — $.15 \times \frac{14 \times 8}{144} = .12$

w = 0.72 KLF

SEISMIC LOAD:

SLAB — $.060 \times 16.54 \times 11.75 = 11.7$ K

$.106 \times 16.54 \times 3.08 = 5.4$

BEAMS — $.15 \times \frac{14 \times 8}{144} \times 12.33 = 1.4$

$.15 \times \frac{14}{12} \times 1.0 \times 15.38 = 2.7$

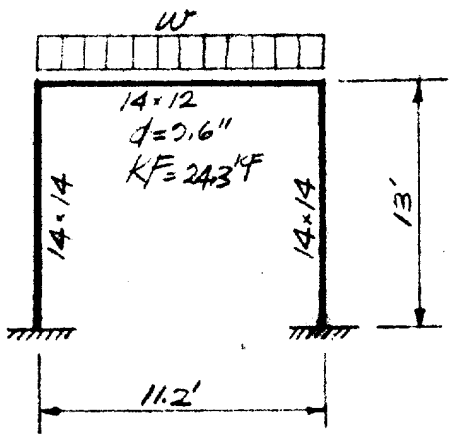
$.10 \times 3.0 \times 15.38 = 4.6$

CMB WALL — $.070 \times 6.0 \times \frac{15.38}{2} = 3.2$

COL. — $.15 \times \frac{14 \times 14}{144} \times 6.5 \times 2 = 2.7$

W = 31.7 K

$F_{SEIS} = .067 \times 31.7 = 2.12$ K



WIND LOAD:

$F_w = .026 \times 16.54 \times 6.6 = 2.80$ K

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(CONT'N OF BEAM ALONG LINE (4) OR (5))

ANALYSIS BY APPROX. METHODS:

AT SUPPORT:

$M_n = 0.75(\frac{1}{20} \times 0.72 \times 11.2^2 + \frac{2.80}{2} \times \frac{13}{2} \times \frac{10}{11.2}) = 0.75(4.52 + 8.12)$

$= 9.48^{KF}$ — $A_s = \frac{9.48}{1.44 \times 9.6} = 0.69^{\square''}$ — 2-#6

$M_p = 0.75 \times 8.12 = 6.09^{KF}$ — $A_s = \frac{6.09}{1.44 \times 9.6} = 0.44^{\square''}$ — 2-#5

$V = 0.75(\frac{1}{2} \times .72 \times 10.0 + 2.80 \times \frac{13}{2} \times \frac{1}{11.2}) = 0.75(3.60 + 1.63) = 3.92^{K}$

$\frac{E_o}{D} = \frac{3920}{186 \times 7/8 \times 9.6} = 2.51''$ — 1 BAR

$v = \frac{3920}{14 \times 9.6} = 29.2 psi$

$s = \frac{4400}{14 \times \frac{2}{3} \times 292} = 16.2'$ — #3 @ 4" STIR.

AT MIDSPAN:

$M_p = \frac{1}{10} \times .72 \times 11.2^2 = 9.03^{KF}$ — $A_s = \frac{9.03}{1.44 \times 9.6} = 0.65^{\square''}$ — 2-#6

$MIN\ A_{sp} = .005 \times 14 \times 9.6 = 0.67^{\square''}$ — 2-#6

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BEAM ALONG LINE ③ OR ⑥

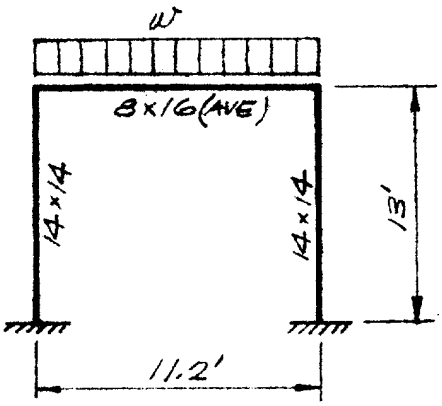
GRAVITY LOAD:

SLAB + LL — $.080 \times 11.17 \times 1/3 = 0.30$ KLF

$.126 \times 2.08 = 0.26$

BEAM — $.15 \times \frac{8}{12} \times 1.0 = 0.10$

$w = 0.66$ KLF



WIND LOAD:

ASSUME $F_w = \frac{1}{3} \times (6.5 \times 50.8 \times .026)$

$= 2.86^K$

BEAM SIZE: 8"×15" @ SUPPORT, $d = 12.6"$

8"×17" @ OTHER SUPPORT, $d = 14.6"$

8"×16" @ MIDSPAN, $d = 13.6"$

ANALYSIS BY APPROX. METHODS:

AT SUPPORT:

$M_n = 0.75\left(\frac{1}{20} \times .66 \times 11.2^2 + \frac{2.86}{2} \times \frac{13}{2} \times \frac{10}{11.2}\right) = 0.75(4.14 + 8.30)$

$= 9.33^{KF}$ — $A_s = \frac{9.33}{1.44 \times 12.6} = 0.52^{0"}$ — 2-#5

$M_p = 0.75(8.30) = 6.22^{KF}$ — $A_s = \frac{6.22}{1.44 \times 12.6} = 0.34^{0"}$ — 2-#5

$V = 0.75\left(\frac{1}{2} \times .66 \times 10.0 + 2.86 \times \frac{13}{2} \times \frac{1}{11.2}\right) = 0.75(3.30 + 1.66) = 3.72^K$

$\frac{\varepsilon_0}{D} = \frac{3720}{186 \times 7/8 \times 12.6} = 1.81"$ — 1 BAR

$v = \frac{3720}{8 \times 12.6} = 36.9$ PSI

$s = \frac{4400}{8 \times \frac{2}{3} \times 36.9} = 22.4"$ — USE #3 @ 6" STIR.

AT MIDSPAN:

$M_p = \frac{1}{10} \times .66 \times 11.2^2 = 8.28^{KF}$ — $A_s = \frac{8.28}{1.44 \times 19.6} = 0.42^{0"}$ — 2-#5

MIN $A_{sp} = .005 \times 8 \times 13.6 = 0.55^{0"}$ — 2-#5

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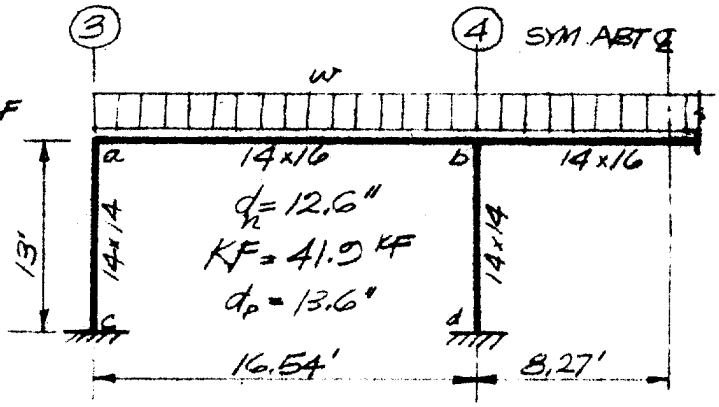
BEAM ALONG LINE (C)



GRAVITY LOAD:

SLAB + LL - .080 x 11.17 x $\frac{1.27}{3}$ = 0.38 KLF

.080 x 7/12 = 0.05

BEAM - .15 x $\frac{14}{12}$ x 1.0 = 0.18

W = 0.61 KLF

FEM = 1/12 x .61 x 16.54^2 = 13.9 KF

DISTRIBUTION FACTORS:

AT 3:

$K_{BM} = \frac{1.5 \times 14 \times 10^3}{16.54 \times 1000} = 5.20$ — 0.64

$K_{COL} = \frac{1.0 \times 14 \times 14^3}{13 \times 1000} = \frac{2.96}{8.16}$ — $\frac{0.36}{1.00}$

AT 4:

$K_{BM} = 2 \times 5.20 = 10.40$ — 0.78

$K_{COL} = \frac{2.96}{13.36}$ — $\frac{0.22}{1.00}$

0.36	0.64		0.39	0.39	
0	+13.9	a	-13.9	+13.9	b
-5.0	-8.9		0	0	
0	0		-4.4	0	
0	0		+1.7	+1.7	
0	+0.8		0	-0.8	
-0.3	-0.5		+0.3	+0.3	
-5.3	+5.3	c	-16.3	+15.1	d

SEISMIC LOAD:

SLAB - .060 x 49.6 x 11.75 = 35.0 K

.106 x 14.83 x 2.08 x 2 = 6.6

.106 x 49.6 x 3.08 = 16.2

BEAMS - .15 x $\frac{8}{12}$ x 1.0 x 10.0 x 2 = 2.0

.15 x $\frac{14 \times 8}{144}$ x 10.0 x 2 = 2.3

.15 x $\frac{14}{12}$ x 1.0 x 50.8 = 8.9

.10 x 3.0 x 50.8 = 15.2

CMU WALL - .070 x 6.0 x 10.0 x 2 = 8.4

COLS - .15 x $\frac{14 \times 14}{144}$ x 6.5 x 8 = 10.6

2W = 105.2 K

W = 52.6 K

WIND LOAD:

F_W = .026 x 12.93 x 6.5 = 2.08 K

F_{SEIS} = .067 x 52.6 = 3.52 K

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(CONT'N OF BEAM ALONG LINE ⓒ)

DIST. FACTORS FOR SUBSTRUCTURE JOINTS:

AT C:

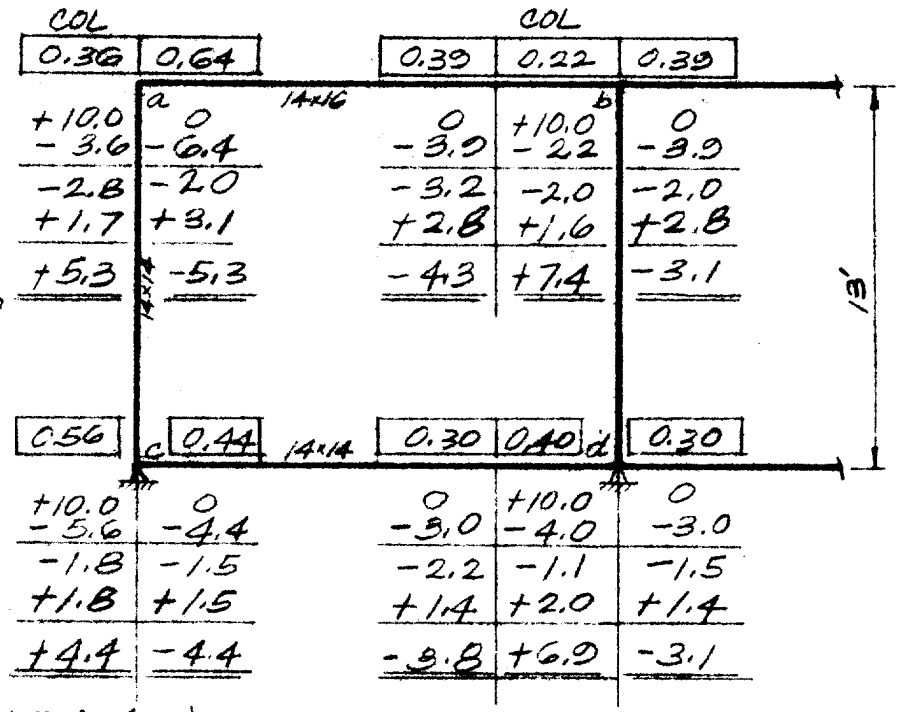
$K_{BM} = \frac{1}{16.54} = .604 - .44$

$K_{COL} = \frac{1}{13} = \frac{.770 - .156}{1.374 - 1.00}$

AT d:

$K_{BM} = 2 \times .604 = 1.208 - 0.60$

$K_{COL} = .770 = \frac{.770 - 0.40}{1.978}$



$F' = \frac{2 \times (5.3 + 4.4 + 7.4 + 6.9)}{13} = \frac{24.0}{6.5} = 3.69^K$

$C.F. = \frac{3.52}{3.69} = 0.953$

$V_a = 0.61 \times \frac{16.54}{2} = 5.05^K$ —

$V_b = 5.05 + \frac{16.3 - 5.3}{16.54} = 5.05 + .67 = 5.72^K$ — $\frac{\varepsilon_o}{D} = \frac{5720}{186 \times 7/8 \times 12.6} = 2.80'' - 1$ BAR

$V_b' = 5.72 - \frac{19.6}{12} \times 0.61 = 5.72 - 1.00 = 4.72^K$ — $v = \frac{4720}{14 \times 12.6} = 26.8$ psi

$S = \frac{4400}{14 \times \frac{2}{3} \times 26.8} = 17.6''$ USE #3@6"

$M_a = 0.75(.953 \times 5.3 + 5.3) = .75(5.3 \times 1.953) = 7.8^{KF}$ — $A_s = \frac{7.8}{1.44 \times 12.6} = .43^{0''} - 2\#5$

$M_b = 16.3^{KF}$ — $A_s = \frac{16.3}{1.44 \times 12.6} = 0.90^{0''}$ — 2-#6

$M_{pab} = \frac{5.72^2}{2 \times .61} - 16.3 = 26.8 - 16.3 = 10.5^{KF}$ — $A_s = \frac{10.5}{1.44 \times 13.6} = .54^{0''} - 2 \cdot \#5$

M_N A_s [illegible] $.95^{0''} - 2\#7$

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BEAM ALONG LINE ©

USE DIMENSIONS BY ARCH'L REQUIREMENTS
PROVIDE NOMINAL REINF.

COLUMN C4 (OTHER COLS. SIMILAR)

LOAD:

SLAB + LL − .080 × 16.54 × 6.17 = 8.16 K
BEAMS − .15 × $\frac{14 \times 8}{144}$ × 5.00 = 0.58
.15 × $\frac{4}{12}$ × 1.0 × 16.54 = 2.90
N = 11.64 K

M = 4.52 + 8.12 = 12.64 KF

R = 1.18 − .009 × $\frac{13 \times 2}{.30 \times 14}$ = 1.18 − .34
= 0.84

$N_{DES} = \frac{.75}{.84} \times 11.64 = 10.40^{K}$ — $\frac{N}{f_c' A_g} = \frac{10.40}{3 \times 14^2} = .0177$

$M_{DES} = \frac{.75}{.84} \times 12.64 = 11.28^{KF}$ — $\frac{12M}{f_c' t A_g} = \frac{12 \times 11.28}{3 \times 14 \times 14^2} = .0165$

$P_g = .01$

$A_s = .01 \times 14^2 = 1.96^{0''}$

USE 14"×14" w/ 4 - #7 & #3 TIES @ 14"

FOOTING C3

LOAD:

SLAB + LL − .080 × 8.27 × 6.17 = 4.08 K
.126 × 1.50 × 6.17 = 1.17
BEAMS − .15 × $\frac{4}{12}$ × 1.0 × 8.27 = 1.45
.15 × $\frac{4}{12}$ × 1.0 × 6.17 = 1.08
CMB WALL − .070 × 11.33 × 5.00 = 3.97
GR. BM — .100 × 1.50 × 5.00 = 0.75
COL. — .15 × $\frac{14 \times 14}{144}$ × 13.00 = 2.66
N = 15.16 K

$A_{FTG} = \frac{15.16 \times 1.10}{1.20} = 13.9$ SF
4'-0" × 4'-0"

TRY t = 10", d = 6.5"

NET $p = \frac{15.16}{4.0^2} = 0.95$ KSF

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(CONT'N OF FTG C2)

$V = 15.16 - 0.95 \times \left(\frac{20.5}{12}\right)^2 = 15.16 - 2.77 = 12.39^K$

$v = \frac{12,390}{4(20.5)6.5} = 23.2\ PSI$

$V = 0.95 \times 4.00 \times \frac{17}{12} = 5.38^K$ — $\frac{E_o}{D} = \frac{5380}{170 \times 4 \times 6.5} = 5.56''$ — 2 BARS

$M = 5.38 \times \frac{17}{24} = 3.81^{K'}$ — $A_s = \frac{381}{1.44 \times 6.5} = 0.41^{\square''}$ — 2-#4

USE 4'-0" x 4'-0" x 10" w/ 4-#4 EW

FOOTING C4

LOAD:

SLAB+LL — .080 x 16.54 x 6.17 = 8.16^K
BEAMS — .15 x $\frac{14}{12}$ x $\frac{8}{12}$ x 5.00 = 0.58
.15 x $\frac{14}{12}$ x 1.0 x 16.54 = 2.90
COLUMN — .15 x $(\frac{14}{12})^2$ x 13.00 = 2.66
N = 14.30^K

USE SAME FTG AS C3

FOOTING D3

LOAD:

SLAB+LL — .080 x 8.27 x 5.58 = 3.69^K
.126 x 1.50 x 8.58 = 1.62
.126 x 3.00 x 8.27 = 3.12
BEAMS — .15 x $\frac{14}{12}$ x 1.0 x 5.00 = 0.87
.10 x 3.0 x 8.85 = 2.66
CMB WALL — .070 x 11.33 x 5.00 = 3.97
GR. BM — .100 x 1.50 x 12.70 = 1.90
COL. — .15 x $\frac{14 \times 14}{144}$ x 13.00 = 2.66
N = 20.49^K

$A_{FTG} = \frac{20.49 \times 1.10}{1.20} = 18.8\ SF$
4'-6" x 4'-6"

NET $p = \frac{20.49}{4.5^2} = 1.01\ KSF$

TRY t = 10" d = 9.5"

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(CONTN OF FTG D3)

$V' = 20.49 - 1.01\left(\frac{20.5}{12}\right)^2 = 20.49 - 2.95 = 17.54^K$

$v = \frac{17,540}{4(20.5)6.5} = 33.0\ PSI$

$V = 1.01 \times 4.5 \times \frac{20}{12} = 7.58^K$ — $\frac{\Sigma o}{D} = \frac{7580}{170 \times 7/8 \times 6.5} = 7.85"$ — 3 BARS

$M = 7.58 \times \frac{20}{24} = 6.32^{KF}$ — $A_s = \frac{632}{1.44 \times 6.5} = 0.675^{0"}$ — 4 BARS

USE 4'-6" x 4'-6" x 10" w/ 5 - #4 EW

FOOTING D4

LOAD:

SLAB + LL — .080 x 16.54 x 5.58 =	7.38 K
.126 x 16.54 x 3.00 =	6.25
BEAMS — .15 x $\frac{8 \times 14}{144}$ x 5.00 =	0.58
.10 x 3.0 x 16.54 =	4.96
CMU WALL — .070 x 11.33 x $\frac{15.38}{2}$ =	6.10
GR BM — .10 x 1.5 x 15.38 =	2.31
COL — .15 x $\left(\frac{14}{12}\right)^2$ x 13.00 =	2.66
N =	30.24 K

$A_{FTG} = \frac{30.24 \times 1.10}{1.20} = 27.7\ SF$

5'-6" x 5'-6"

NET $p = \frac{30.24}{5.50^2} = 1.00\ KSF$

TRY t = 12", d = 8.5"

$V' = 30.24 - 1.00\left(\frac{22.5}{12}\right)^2 = 30.24 - 3.52 = 26.72^K$

$v = \frac{26720}{4 \times 22.5 \times 8.5} = 35.0\ PSI$

$V = 1.00 \times 5.5 \times \frac{26}{12} = 11.9^K$ — $\frac{\Sigma o}{D} = \frac{11900}{170 \times 7/8 \times 8.5} = 9.42"$ — 3 BARS

$M = 11.9 \times \frac{26}{24} = 12.9^{KF}$ — $A_s = \frac{12.9}{1.44 \times 8.5} = 1.05^{0"}$ — 6 - #4

USE 5'-6" x 5'-6" x 12" w/ 7 - #4 EW

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GRADE BEAM SUPPORTING CHB WALL ALONG LINE (D)

BY INSPECTION SEISMIC LOAD DOES NOT GOVERN.

GRAVITY LOAD:

CHB WALL — .070 × 9.0 = 0.63 KLF
GR. BM — .10 × 1.5 = 0.15
0.78 KLF

SIZE — 7 5/8 × 18"
d = 14.2"

$V = 0.78 \times 15.38 \times 1/2 = 6.00^K$ — $\frac{E_o}{D} = \frac{6000}{170 \times 7/8 \times 14.2} = 2.84'$

$V_d = 6.00 - .78 \times \frac{14.2}{12} = 6.00 - 0.92 = 5.08^K$

$v = \frac{5,080}{7.62 \times 14.2} = 47.0 PSI$ — $S = \frac{4400}{7.62 \cdot \frac{2}{3} \times 47.0} = 18.4"$ USE #3@6"

$M = 0.78 \times \overline{15.38}^2 \times 1/12 = 15.4^{KF}$ — $A_S = \frac{15.4}{1.44 \times 14.2} = 0.75$ — 2-#6

USE 7 5/8" × 18" w/ 2-#6 TOP, 2 #6 BOT, & #3 STIR @ 6"

TIE BEAM

USE 14" × 14" w/ 2-#7 TOP, 2 #7 BOT, & #3 TIES @ 6"

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ROOF SLAB (TWO-WAY, FOUR EDGES DISCONT., 18.5' × 23.2')

LOAD:

6" SLAB	= 0.075 KSF
ROOFING	= .006
DUCTS, ETC.	= .004
PIPES, TANKS, ETC	= .010
DL	= 0.095 KSF
LL	= 0.020
W	= 0.115 KSF

MIN. $t = \frac{24}{180}(18.5+23.2) = \frac{24\times41.7}{180}$

$= 5.56"$

USE $t = 6"$ $d_1 = 5.00"$

$d_2 = 4.50" - KF = 4.6^{KF}$

$m = \frac{18.5}{23.2} = .080$

$WS^2 = 0.115 \times 18.5^2 = 39.4^{KF/LF}$

$M_{SD} = .043 \times 39.4 = 1.69^{KF/LF}$ — $A_S = \frac{1.69}{1.44\times5.0} = .235^{0"/LF}$ — #3@5"

$M_{SP} = .064 \times 39.4 = 2.52$ — $A_S = \frac{2.52}{1.44\times5.0} = .350$ — #4@6"

$M_{LD} = .033 \times 39.4 = 1.30$ — $A_S = \frac{1.30}{1.44\times4.5} = .201$ — #3@6"

$M_{LP} = .050 \times 39.4 = 1.97$ — $A_S = \frac{1.97}{1.44\times4.5} = .304$ — #4@8"

$V = 0.5 \times .115 \times 18.5 = 1.06$ — $E_o/D = \frac{1060}{170\times\frac{7}{8}\times4.5} = 1.59"/LF$ — @23"

ROOF SLAB OVERHANG (L' = 4.0')

LOAD: $W = 0.100^{SLAB} + .006^{RFG} + .020^{LL} = 0.126$ KSF

THICKNESS OF SLAB AT SUPPORT = 6", $d = 5.0"$

$V = 0.126 \times 4.00 = 0.504^{K/LF}$ — $\frac{E_o}{D} = \frac{504}{186\times\frac{7}{8}\times5.0} = 0.62"/LF$ - @

$M = 0.504 \times \frac{4.00}{2} = 1.01^{KF/LF}$ — $A_S = \frac{1.01}{1.44\times5.0} = 0.14^{0"/LF}$ — #3@9"

TEMP $A_S = .002 \times 12 \times 7 = .168^{0"}$ — #3@8"

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BEAM ALONG LINE (1) (ALONG LINE (2) SIMILAR)

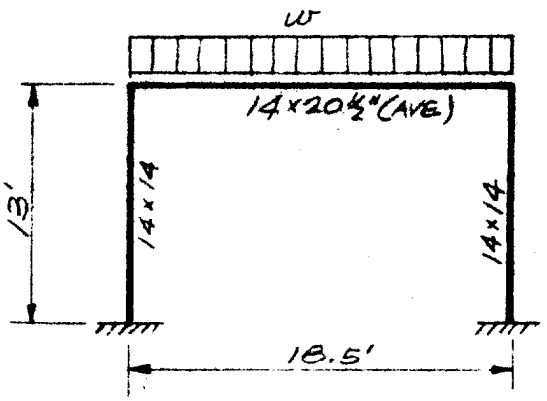
GRAVITY LOAD:

SLAB + LL — $.115 \times 18.5 \times 1/3 = 0.71$ KLF

$.126 \times 1.5 = 0.19$

BEAM — $.15 \times \frac{14}{12} \times 1.25 = 0.22$

$W = 1.12$ KLF



SEISMIC LOAD:

SLAB — $.095 \times 21 \times 13 = 25.9^K$

BEAMS — $.15 \times \frac{14}{12} \times 1.25 \times 19.7 = 4.3$

$.15 \times \frac{14}{12} \times 3.0 \times 11.0 = 5.8$

$.15 \times \frac{14}{12} \times 1.5 \times 11.0 = 2.9$

COL. — $.15 \times \frac{14 \times 14}{144} \times 6.5 \times 2 = 2.7$

$W = 41.6^K$

$F_{SEIS} = 0.067 \times 41.6 = 2.79^K$

WIND LOAD:

$F_w = .026 \times 6.5 \times 12 = 2.03^K$

BEAM SIZE: 14" x 18" @ ONE SUPPORT, $d = 15.5$"

14" x 23" @ OTHER SUPPORT, $d = 20.5$"

14 x 20.5" @ MIDSPAN, $d = 18.0$"

ANALYSIS BY APPROX. METHODS:

(PT. OF CONTRAFLEXURE ASSUMED TO BE AT 1/3 OF COL.)

AT SUPPORT:

$M_n = 0.75\left(\frac{1}{20} \times 1.12 \times 18.5^2 + \frac{2.79}{2} \times \frac{2}{3} \times 13 \times \frac{17.33}{18.5}\right) = 0.75(19.2 + 11.4)$

$= 22.9^{KF}$ — $A_s = \frac{22.9}{1.44 \times 5.5} = 1.03^{\square"}$ — 2-#7

$V = 0.5 \times 1.12 \times 17.33 = 9.72^K$ — $\frac{E_\ell}{D} = \frac{9720}{186 \times 7/8 \times 15.5} = 3.86"$ — 2 BARS

$v = \frac{9720}{14 \times 155} = 44.8$ psi — $s = \frac{4400}{14 \times \frac{2}{3} \times 44.8} = 10.5"$ — #3 @ 8"

AT MIDSPAN:

$M_p = \frac{1}{8} \times .112 \times 18.5^2 = 48.0^{KF}$ — $A_s = \frac{48.0}{1.44 \times 18.0} = 1.85^{\square"}$ — 3-#7

MIN $A_{sp} = .005 \times 14 \times 18.0 = 1.26^{\square"}$ — 2-#7

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BEAM ALONG LINE (A)

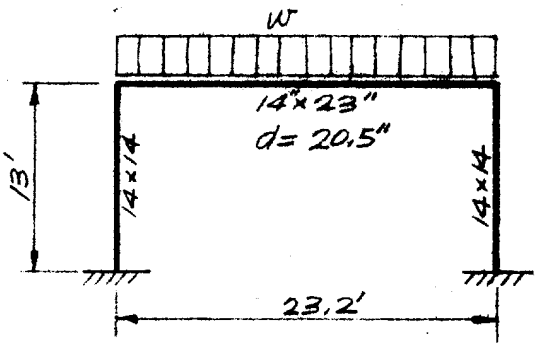
GRAVITY LOAD

SLAB + LL — $.115 \times \frac{18.5}{3} \times 1.20 = 0.85$ KLF

$.115 \times 1.0 = 0.12$

BEAM — $.15 \times 1.5 \times \frac{14}{12} = 0.26$

$W = 1.23$ KLF



SEISMIC LOAD:

SLAB — $.085 \times 10.2 \times 26 = 25.2$ K

BEAMS — $.15 \times \frac{14}{12} \times 1.5 \times 22 = 5.8$

$.15 \times \frac{14}{12} \times 1.5 \times 10 = 2.6$

CMB WALL — $.070 \times 6.5 \times 8.67 = 3.9$

COL. — $.15 \times \frac{14 \times 14}{144} \times 6.5 \times 2 = 2.7$

$W = 40.2$ K

$F_{SEIS} = .067 \times 40.2 = 2.70$ K

0.18	0.82
0	+55.2
-10.0	-45.2
0	+22.6
-4.1	-18.5
0	+ 9.2
-1.7	- 7.5
0	+ 3.8
0.7	- 3.1
0	+ 1.6
-0.3	- 1.3
-16.8	+16.8 KP

DISTRIBUTION FACTORS:

$K_{BM} = \frac{1.8 \times 14 \times 23^3}{23.2 \times 1000} = 13.20$ — 0.82

$K_{COL} = \frac{10 \times 14 \times 14^3}{13 \times 1000} = \frac{2.06 - 0.18}{16.16 - 1.00}$

$FEM_{D+L} = \frac{1}{12} \times 1.23 \times 23.2^2 = 55.2$ KF

$M_n = 0.75\left(16.8 + \frac{2.70}{2} \times \frac{2 \times 13}{3} \times \frac{22.0}{23.2}\right) = 0.75(16.8 + 11.1) = 20.9$ KF

$A_S = \frac{20.9}{1.44 \times 20.5} = 0.71$ in^2 — 2-#6

$M_p = \frac{1}{8} \times 1.23 \times 23.2^2 - 16.8 = 82.8 - 16.8 = 66.0$ KF — $A_S = \frac{66.0}{1.44 \times 20.5} = 2.24$ in^2 — 3-#8

$V = 0.5 \times 1.23 \times 22.0 = 13.5$ K — $\frac{\Sigma o}{D} = \frac{13500}{186 \times 7/8 \times 20.5} = 4.05$" — 2 BARS

$v = \frac{13500}{14 \times 20.5} = 47.0$ psi — $s = \frac{4400}{14 \times \frac{2}{3} \times 47.0} = 10.0$" — #3 @10"

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BEAM ALONG LINE (B)

USE DIMENSIONS BY ARCH'L REQUIREMENTS.
PROVIDE NOMINAL REINF.

COLUMN A2 (OTHER COLS SIMILAR)

LOAD:

SLAB + LL — $.115 \times 10.2 \times 13.0 = 15.2$
BEAMS — $.15 \times \frac{14}{12} \times 1.5 \times 11.0 = 2.9$
$.15 \times \frac{14}{12} \times 1.5 \times 10.0 = 2.6$
$N = 20.7^K$

$M = 16.8 + 11.1 = 27.9^{KF}$

$R = 1.18 - .009 \times \frac{13 \times 12}{30 \times 14} = 1.18 - .34$
$= 0.84$

$N_{DES} = \frac{0.75}{0.84} \times 20.7 = 18.5^K$ — $\frac{N}{f_c' A_g} = \frac{18.5}{3 \times 14^2} = .0314$

$M_{DES} = \frac{0.75}{0.84} \times 27.9 = 24.9^{KF}$ — $\frac{12M}{f_c' t A_g} = \frac{12 \times 24.9}{3 \times 14 \times 14^2} = .0363$

$\Big\rangle \; P_g = 0.02$

$A_S = 0.02 \times 14^2 = 3.92^{\square''}$ — 4 - #9

USE 14"×14" W/ 4-#9 & #3 TIES @14"

FOOTING A1

LOAD:

SLAB + LL — $.115 \times 13.0 \times 10.2 = 15.2^K$
BEAMS — $.15 \times \frac{14}{12} \times 1.5 \times 11.0 = 2.9$
$.15 \times \frac{14}{12} \times 1.5 \times 10.0 = 2.6$
CHB WALL — $.070 \times 11.33 \times 13.7 = 10.9$
GR. BM — $.10 \times 1.5 \times 13.7 = 2.1$
COL — $.15 \times \frac{14 \times 14}{144} \times 13.0 = 2.7$
$N = 36.4^K$

$A_{FTG} = \frac{36.4 \times 1.10}{1.20} = 33.4 \text{ SF}$
6'-0" × 6'-0"

NET $p = \frac{36.4}{6^2} = 1.01 \text{ KSF}$

TRY $t = 12"$, $d = 8.5"$

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(CONT'N OF FTG. A1)

$V' = 36.4 - 1.01\left(\frac{22.5}{12}\right)^2 = 36.4 - 3.5 = 32.9^K$

$v = \frac{32900}{4(22.5)85} = 43.0\ PSI$

$V = 1.01 \times 6.0 \times \frac{22}{12} = 14.6^K$ — $\frac{E_o}{D} = \frac{14600}{170 \times \frac{7}{8} \times 8.5} = 11.5"$ — 4 BARS

$M = 14.6 \times \frac{22}{24} = 17.7^{KF}$ — $A_S = \frac{17.7}{1.44 \times 8.5} = 1.45^{D"}$ — 8-#4

USE 6'-0" x 6'-0" x 12" w/ 8-#4 EW

FOOTING A2

$N = 20.7 + 2.7 = 23.4^K$

$A_{FTG} = \frac{23.4 \times 1.10}{1.20} = 21.4\ SF$ — 5'-0" x 5'-0"

$NET\ p = \frac{23.4}{5^2} = 0.94\ KSF$

USE $t = 12"$ $d = 8.5"$

$V = 0.94 \times 5.0 \times \frac{23}{12} = 9.0^K$ — $\frac{E_o}{D} = \frac{9000}{170 \times \frac{7}{8} \times 8.5} = 7.12"$ — 3 BARS

$M = 9.0 \times \frac{23}{24} = 8.62^{KF}$ — $A_S = \frac{8620}{1.44 \times 8.5} = 0.71^{D"}$ — 4-#4

USE 5'-0" x 5'-0" x 12" w/ 5-#4 EW

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(N6)

FOOTING B1 (FTG B2 SIMILAR)

LOAD:

SLAB + LL − .115 × 10.8 × 13.0 = 16.2
BEAMS − .15 × $\frac{14}{12}$ × 1.5 × 10.0 = 2.6
.10 × 3.0 × 11.0 = 3.3
CHB WALL − .070 × 11.33 × 8.67 = 6.9
GR. BM − .10 × 1.5 × 8.67 = 1.3
COL − .15 × $\frac{14 \times 14}{144}$ × 13.0 = 2.7
N = 33.0^K

$A_{FTG} = \frac{33.0 \times 1.10}{1.20} = 30.2$ SF
5'-6" × 5'-6"

NET $p = \frac{33.0}{5.5^2} = 1.09$ KSF

TRY $t = 12"$, $d = 8.5"$

$V' = 33.0 - 1.09\left(\frac{22.5}{12}\right)^2 = 33.0 - 3.8 = 29.2^K$

$v = \frac{29,200}{4(22.5)(8.5)} = 38.2$ psi

$V = 1.09 \times 5.5 \times \frac{26}{12} = 13.0^{KF}$ — $\frac{E_o}{D} = \frac{13000}{170 \times \frac{7}{8} \times 8.5} = 10.3"$ — 4 BARS

$M = 13.0 \times \frac{26}{24} = 14.1^{KF}$ — $A_s = \frac{14.1}{1.44 \times 8.5} = 1.15^{0"}$ — 7-#4

USE 5'-6" × 5'-6" × 12" w/ 7-#4 EW

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